MoDOT Technician Certification Program

Math Topics

The completion of the MoDOT Technician Certification Program courses depends on the comprehension of several math topics. The topic list below does not include all possible topics but covers the most probable occurrences.

Percentages
Fractions
Areas
Volumes
Rounding Values
Algebra
Multiple Calculations

The enclosed information covers these topics in the following format; definition, example, trial problems, and answer to trial problems. This information is provided to participants for their self-study of the math topic provided. Lack of preparation in this area may cause poor performance in the certification program.

DEFINITIONS

Percentages: This topic covers the use and determination of a percentage value. Percentages are parts of a whole and their values are calculated to determine specification compliance and used to compute test result values.

Fractions: This topic covers the conversion of a fraction to a percentage value and the computation of a fraction of a number.

Area: This topic covers the calculation of areas of rectangles, circles, and triangles.
Area of a rectangle = width x length
Area of a circle = 3.14159 x radius x radius, Diameter = 2 x radius
Area of a triangle = width x height / 2

Volume: This topic covers the calculation of volumes of cylinders and boxes.
Volume of a cylinder = area of top x height
Volume of a box = area of top x height

Algebra: This topic covers the use of algebraic equations and the solutions of these equations.

Rounding: This topic covers the proper rounding procedures as defined by AASHTO and outlined in the MoDOT Materials Manual paragraph 1001.7 from the Volume 1, Field Section. This paragraph is in attachment A.

Calculations: This topic covers the procedures necessary to complete multiple calculations and the effects rounding in calculations.

EXAMPLES

Rounding: If the calculator shows the value of 5.1435698 and the reporting requirement is 2 decimal places the reported value is 5.14.

Calculations: The first step of a process is to determine a value, which on the calculator showed 3.1435698 and was to be reported to 3.14. If this value is then to be multiplied by 11 to determine a final value rounded to 1 decimal place the following to answers might be determined.

3.1435698 x 11 = 34.579267 = 34.6

3.14 x 11 = 34.54 = 34.5

The second equation is the correct process since it is required that the first value be reported to 2 decimal places. It is improper to use the non-rounded value.

This 1 tenth difference in the final result would make a difference in compliance with the specification if the limit was a maximum of 34.5. The first calculation would cause a failing value to be reported.

At intermediate steps the proper rounding and reporting procedures must be followed to ensure proper calculation of values.

Percentages: 1. What is 80% of 300? 80/100 * 300 = 240

If it was stated that 80% of a 300 gram sample was aggregate then the calculation of the weight of the aggregate would be completed as shown above. The weight of the aggregate being 240 grams.

80 is divided by 100 and then multiplied by 300 to yield the result of 240.

2. 1640 comprises what percent of 2000? 1640/2000 * 100 = 82%

If the original weight of a sample is 2000 grams and the amount, which passes a No. 4 sieve, is 1640 grams. The percent passing would be 82%.

1640 is divided by 2000 and then multiplied by 100 to yield the percentage result of 82%.

Fractions:

1. What is 1/3 of 600? 1/3*600 = 200

If the volume of a container is 600 and it is 1/3 full of water then the water volume would be 200.

1 is divided by 3 and then multiplied by 600 to yield 200.

2. Express 2/25 as a percentage. 2/25*100 = 8%

If there are 25 total units of a product and 2 units are component "A" then the percentage expression of component "A" would be 8%.

2 is divided by 25 and then multiplied by 100 to yield 8.

Area:

1. What is the area of a rectangle 8" by 10"? 8" x 10" = 80 square inches

If the width of the steel plate is 8" and the length is 10" then the area of the plate is 80 square inches.

8 multiplied by 10 yields 80

2. What is the area of a circle with a radius of 3"? 3.14159 x 3 x 3 = 28.27 square inches

If the top of a cylinder has a radius of 3" then the area of the top of the cylinder is 28.27 square inches.

3.14159 multiplied by 3 multiplied by 3 yields 28.27

3. What is the area of a triangle with a width of 2' and a height of 10'? 2 x 10 / 2 = 10 square feet.

If a pavement slab is the shape of a triangle with a width of 2' and a height of 10' then the area of the slab is 10 square feet.

2 multiplied by 10 divided by 2 yields 10

Volume:

1. What is the volume of a cylinder with a radius of 4” and height of 10”?
3.14159 x 4 x 4 x 10 = 502.6 cubic inches

If a cylinder has a radius of 4” and a height of 10” then the volume is 502.6 cubic inches.

3.14 multiplied by 4 multiplied by 4 multiplied by 10 yields 502.6

2. What is the volume of a box with a width of 3’, length of 10’ and a height of 4’? 3 x 10 x 4 = 120 cubic feet

If a box shaped hole is excavated with a width of 3’, length of 10’ and a height of 4’ then the volume is 120 cubic feet.

3 multiplied by 10 multiplied by 4 yields 120

Algebra:

What is the value of “X” in the equation 4 + 5X = 14?

-4 + 4 + 5X = 14 – 4 (4 is subtracted from each side of the equation)
5X = 10 (This is the result of the subtracting 4 from each side)
5X / 5 = 10 / 5 (Each side is divided by 5)
X = 2 (This is the result of dividing each side by 5)

See the attached algebra worksheet, attachment B, for more detailed information.

Trial Problems Report all results to 1 decimal place unless otherwise noted.

Percentages: What is 65% of 840?

What is 15% of 1256?

12 is what percent of 25?

845 is what percentage of 2456?

Fractions: Convert 4/23 to a percentage equivilant.

What is the percentage equivalent of 22/57?

What is 1/5 of 260?

What is 3/45 of 975?

Area: What is the area of a rectangle 2’ by 15’?

What is the area of a rectangle 50’ by 50’?

What is the area of a circle with a 33’ radius?

What is the area of a circle with a 0.5” diameter?

What is the area of a triangle with a width of 4’ and height of 11’?

What is the area of a triangle with a width of 30” and height of 44”?

Volume: What is the volume of a cylinder with a radius of 4” and height of 12”?

What is the volume of a cylinder with a top area of 20 square inches and a height of 24”?

What is the volume of a box with a width of 24”, length of 12”, and height of 4”?

What is the volume of a box with a width of 30’, length of 105’ and height of 2’?

Rounding: Round 5.1435698 to a 1 tenth value?

Round 6.1435698 to a 3 decimal place value?

Algebra: Solve for X. 2*X + 10 = 20

Solve for X. 7*X - 3 = 46

Solve for X. 6*X + 3 = - 27

Solve for X. - 2*X + 5 = 13

Trial Problem Answers

Percentages:

What is 65% of 840? **546.0**

What is 15% of 1256? **188.4**

12 is what percent of 25? **48.0%**

845 is what percentage of 2456? **34.4%**

Fractions:

What is the percentage equivalent of 4/23? **17.4%**

What is the percentage equivalent of 22/57? **38.6%**

What is 1/5 of 260? **52.0**

What is 3/45 of 975? **65.0**

Area:

What is the area of a rectangle 2' by 15'? **30.0 square feet**

What is the area of a rectangle 50' by 50'? **250.0 square feet**

What is the area of a circle with a 33' radius? **3421.2 square feet**

What is the area of a circle with a 0.5" diameter? **0.2 square inches**

What is the area of a triangle with a width of 4' and height of 11'? **22.0 square feet**

What is the area of a triangle with a width of 30" and height of 44"? **660.0 square feet**

Volume:

What is the volume of a cylinder with a radius of 4" and height of 12"? **603.2 cubic inches**

What is the volume of a cylinder with a top area of 20 square inches and a height of 24"? **480.0 cubic inches**

What is the volume of a box with a width of 24", length of 12", and height of 4"? **1152.0 cubic inches**

What is the volume of a box with a width of 30', length of 105' and height of 2'? **6300.0 cubic feet**

Rounding: Round 5.1435698 to a 1 tenth value? **5.1**

Round 6.1435698 to a 3 decimal place value? **6.144**

Algebra: Solve for X. 2*X + 10 = 20 **X = 5**

Solve for X. 7*X - 3 = 46 **X = 7**

Solve for X. 6*X + 3 = - 27 **X = -5**

Solve for X. - 2*X + 5 = 13 **X = -4**